

# Georgia Commission on E-Commerce & Freight Infrastructure Funding Meeting



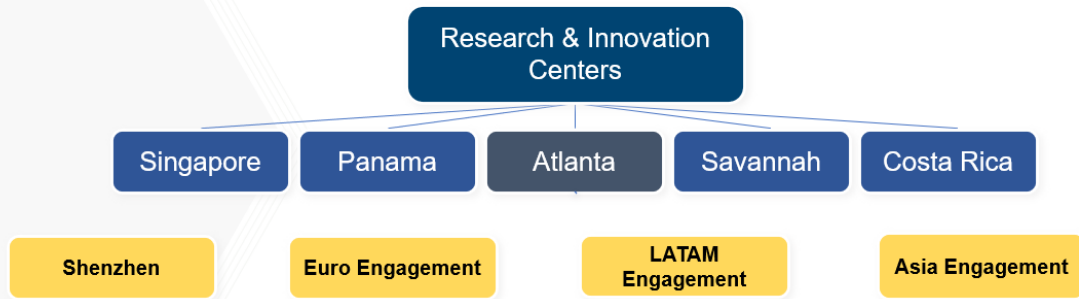
*Georgia's Interdisciplinary Center for Research, Education, Innovation, and Engagement in Supply Chain & Logistics*



Tim Brown  
Managing Director  
[timbrown@gatech.edu](mailto:timbrown@gatech.edu)  
[www.scl.gatech.edu](http://www.scl.gatech.edu)

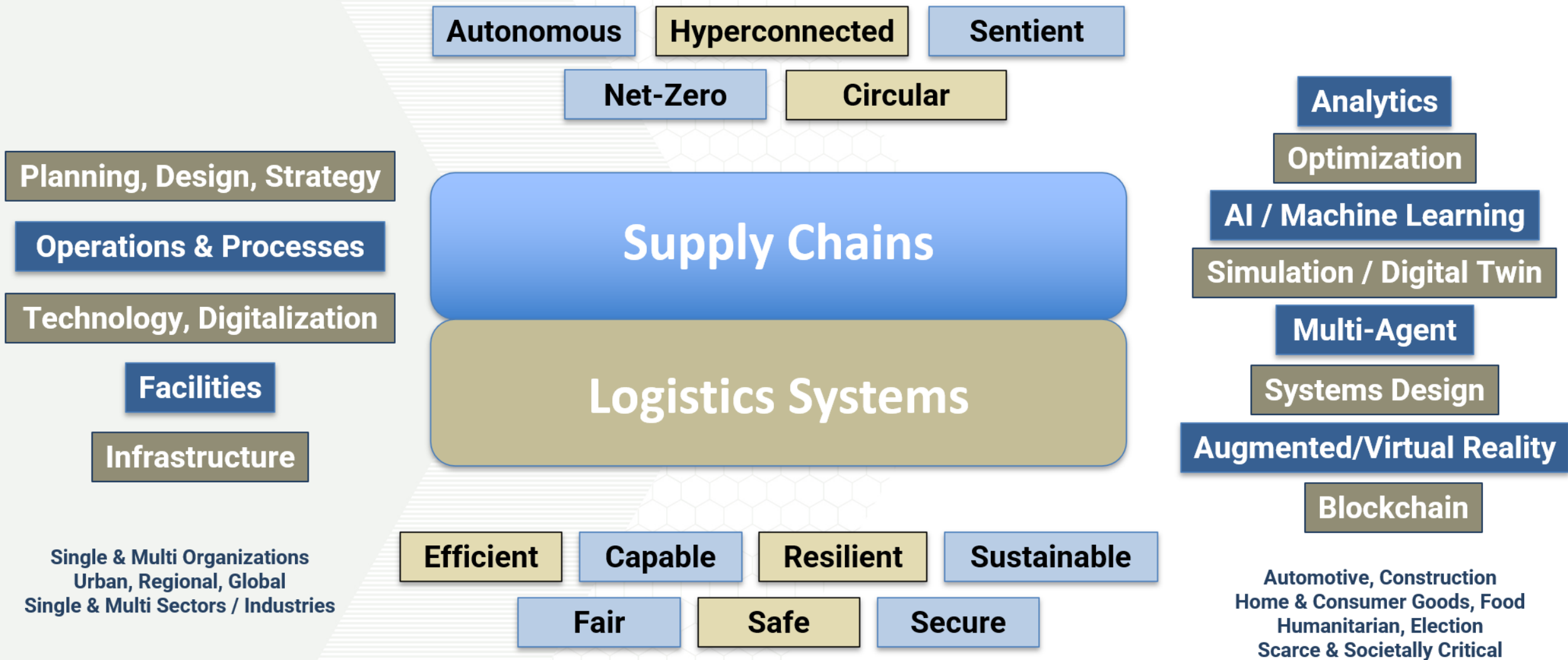
August 23, 2021

# Supply Chain & Logistics Institute



- Largest Supply Chain and Logistics Program in the US
- Home department: Industrial and Systems Engineering, Ranked #1, 31 years in a row
- Degree ~1,500 students/Non-Degree ~8,000 students
- 100 SCL-affiliated faculty across all disciplines
- Life-long learning: Summer Camps, Degree Programs, Continuous Education, Juvenile Justice/URM/GED programs
- Interdisciplinary Research Center – addressing societal needs through collaborative research projects
- Global Reach and Partnerships

# Interdisciplinary Research Framework



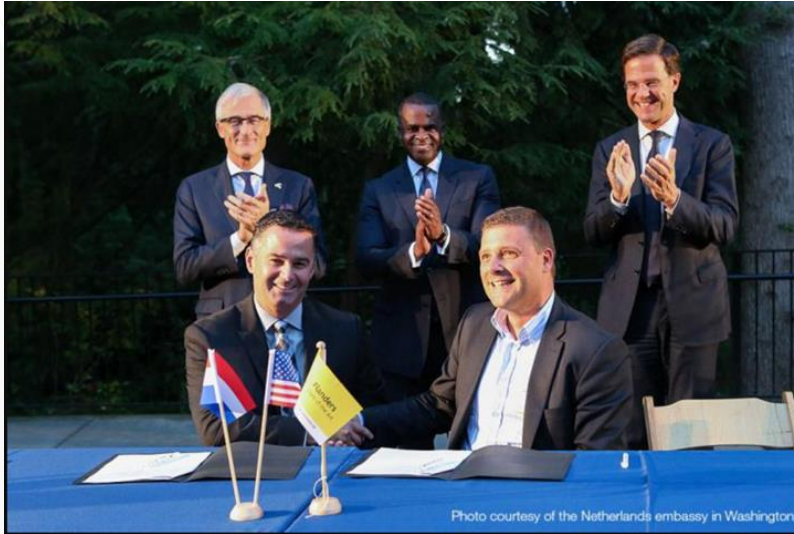
# Representative Sponsored Research Partners

- **Cisco**
- Nissan
- Daimler
- Bombardier
- SF Express
- **UPS**
- Grub Hub
- **YKK**
- Microsoft
- MiTek
- **Georgia Ports Authority**
- Aldi
- ExxonMobile
- **ThyssenKrupp**
- **The Home Depot**
- **Marine Corps Logistics Command**
- **General Electric**
- Steelcase

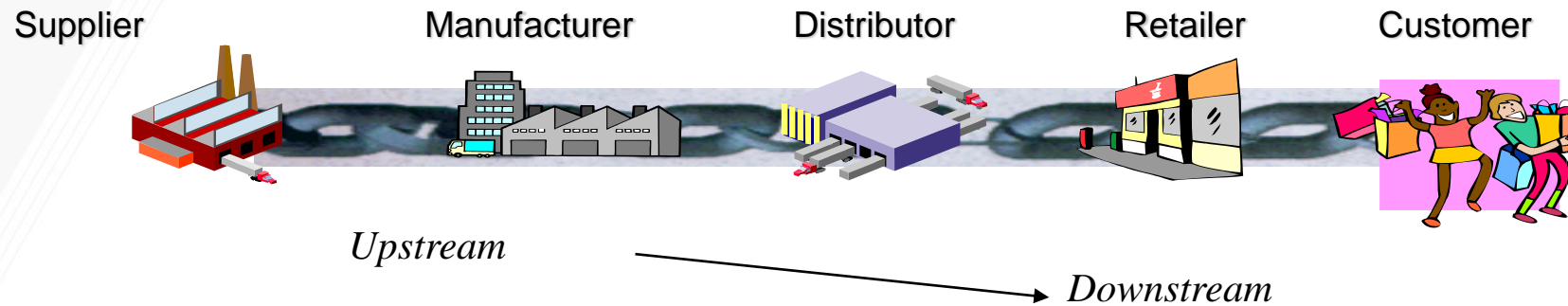
**Topics:** Last-mile logistics; Next generation containerization; Resource Optimization; Facility Optimization; Physical Internet; Inventory Management; Transportation Optimization; Network Optimization; Digital Twins; Revenue Optimization



# Bringing the World to Georgia and Georgia to the World



# Defining Supply Chain Management

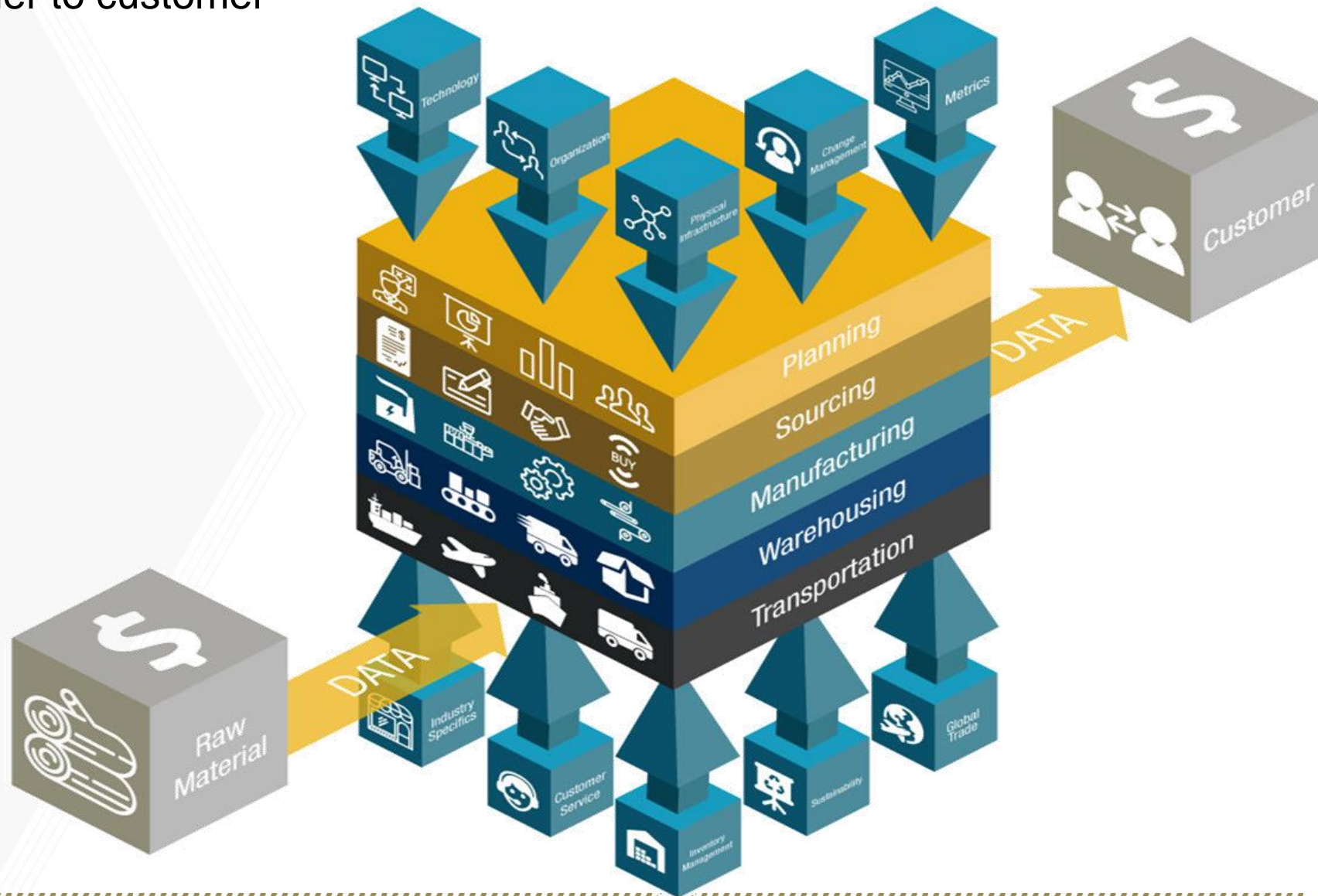


Source: ASCM/Supply Chain Council

Supply Chain Operations Reference Model (SCOR)



**Supply Chain:** an integrated system of **processes**, **organizations**, **people**, **information** flows, **financial** flows, and **physical** resources involved in creating and moving a product or service from raw material/supplier to customer



# Supply Chain Management is a Profession



- Supply Chain Management
- Logistics
- Inventory
- Logistics
- Transportation
- Manufacturing
- Procurement
- Sourcing

- Distribution Operations
- Product Life Cycle Management
- Reverse Logistics
- Service Supply Chain
- Supply & Demand Planning
- SC Strategy
- SC IT



# Interstate Highways Foster Trucking & Freight

I-75 & I-95: Key North-South Transcontinental Interstate Highways

I-16, I-20, I-59 & I-85 Put GA on Direct Route to 15 Other States



Truck Freight from GA Can Reach 80% of U.S. Markets Within 2 Days

Seaports Direct Access to Interstates and 2 Class I Railroads, Largest Intermodal Facility

# ATL Airport Enables People and Freight Mobility

## Impact

Generates \$34.8B Economic Impact for Metro Atlanta

## Reach

A 2-hour Flight Reaches 80% of U.S. Population (Cargo or Passengers)

## Trade

250 Acre Adjoining 'Georgia Foreign-Trade Zone' Provides Competitive Edge for Trade



## People

Busiest in the World, Serving 275,000 Passengers per Day

## Access

Connects w/ 170 U.S. Cities, 75 International Cities, and 50 Foreign Countries

## Cargo

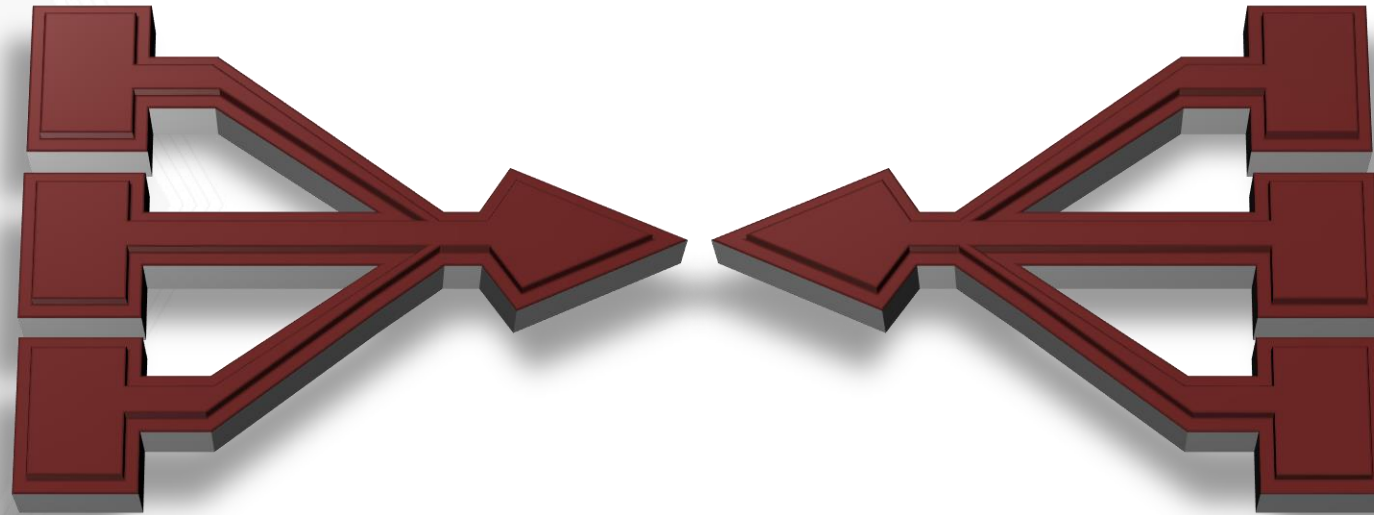
28 Parking Positions for Cargo Aircraft, 2M sf of Air Cargo Warehouse Space, USDA Perishables Complex

# GA Logistics Infrastructure Connects A-to-B

**Marine:** Largest single container terminal in Western Hemisphere.  
FY2020 - 4.4 million TEUs ; Moved 21.6% of East Coast container trade.

**Rail:** 2 Class-I Railroads, 3 Inland Ports w/ Direct Rail, Largest Intermodal Facility on East Coast

**Pipeline:** Colonial is Largest U.S. Refined Products Pipeline, 5,500 Miles, Moves 3M Barrels



**Trucking:** Reaches 80% of U.S. Consumers in 2 Days, 15 Interstates, 450K CDL Drivers

**Air:** ATL Airport Cargo #10 in U.S., 80% of Markets in 2 Hours, 2M sf of On-Airport Warehousing

**Warehousing & Distribution:** 90% of Top 3PL's, 800M sf of Space, 14M sf Cold-Storage



# Epicenter for Warehousing and Distribution



800M sf of W&D Space



314,000 Warehouse-Related Workers



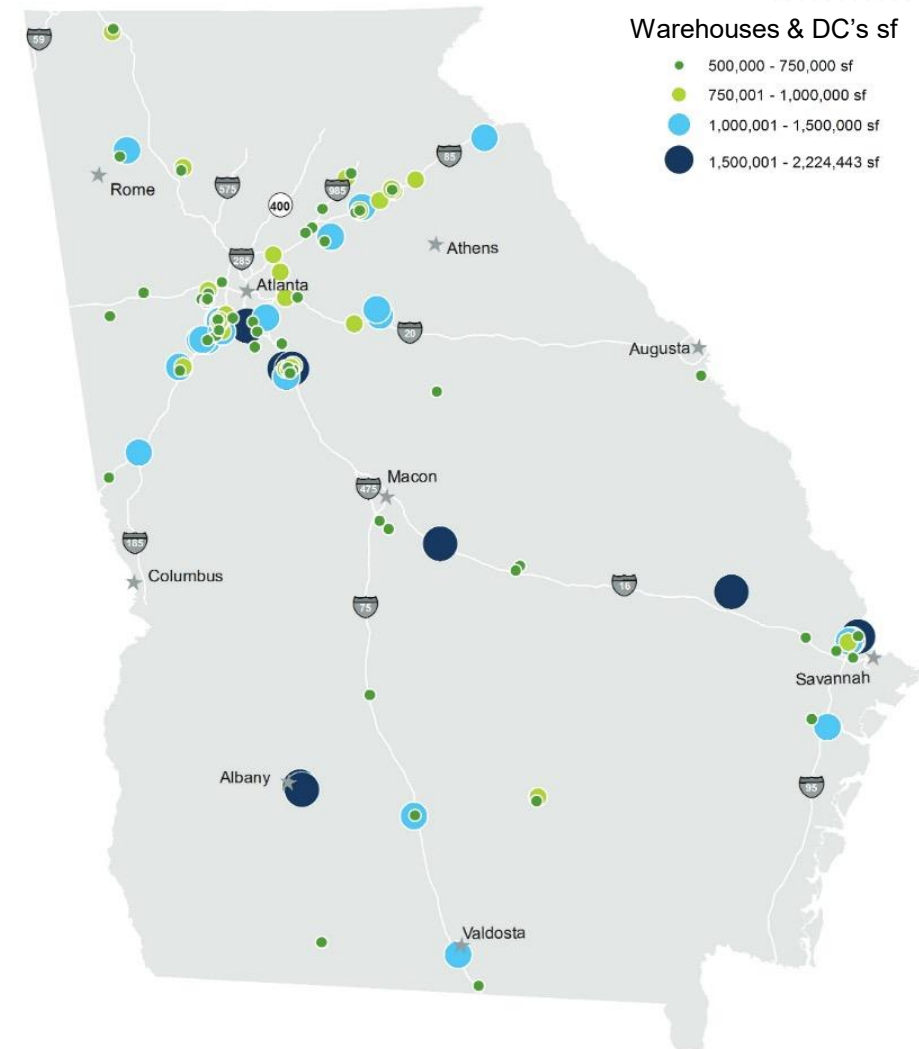
#2 Most Affordable Market & #6 Largest



Headquarters to 4 of Top 10 W&D Providers



90% of Top 25 Global 3PL's Located in GA



Source: Business Wise & CoStar, 2017

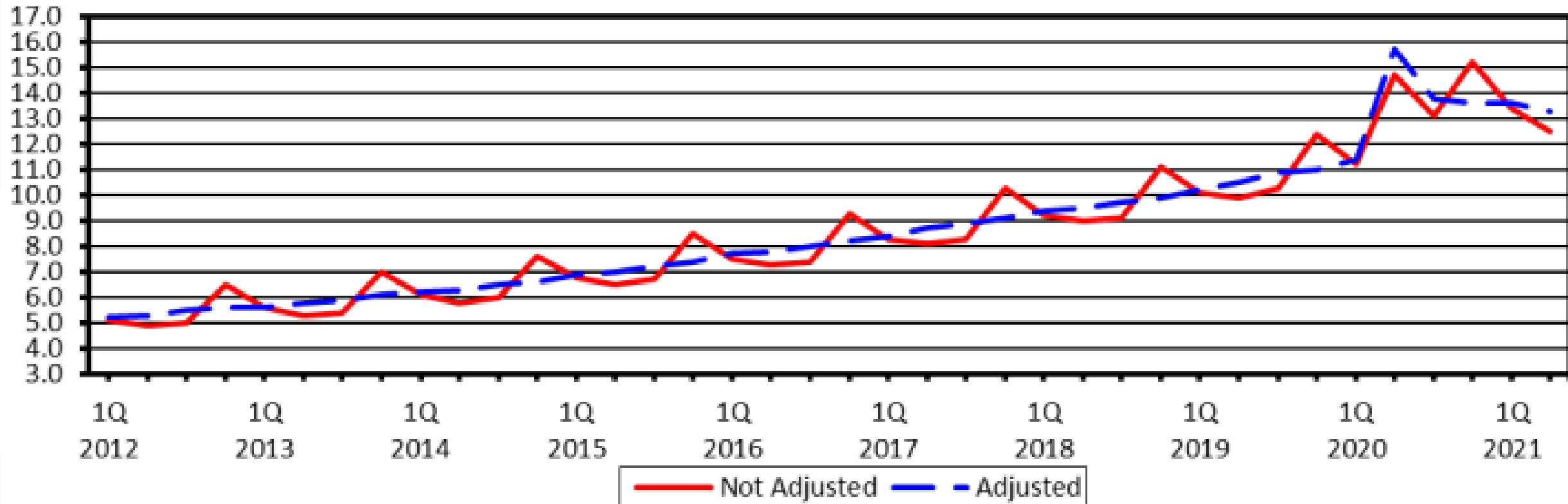
# Fundamental Change in Commerce

- Diminishing role of retail stores
- Delivery of product directly to consumers
- Product “definition” includes a service element
  - When can I get it?
- ***Last mile logistics***
  - Increased complexity!



# U.S. e-commerce sales as % of retail sales

Percent of Total



Impacts on Distribution Centers – number, size, locations, capabilities, labor, equipment  
Impacts on Transportation – volume, locations, flows, congestion, timing



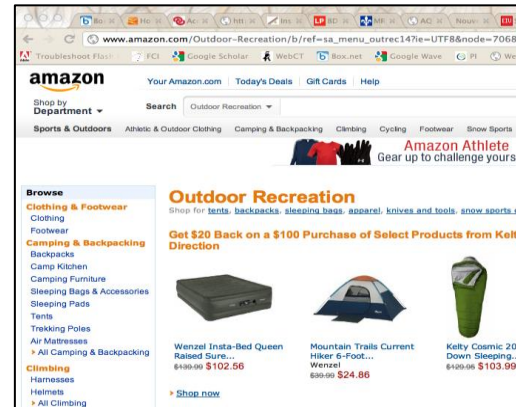
# Harsh Claim

The way physical objects are  
moved, stored, realized, supplied and used  
throughout the world  
is economically, environmentally and socially  
inefficient and unsustainable

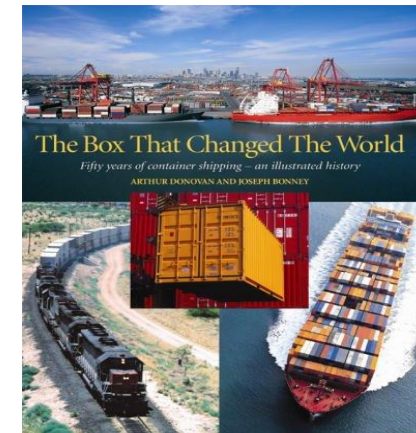
## Lifestyle



## E-Commerce



## World Trade



# Worldwide Grand Challenge Driving Toward Next-Generation Logistics

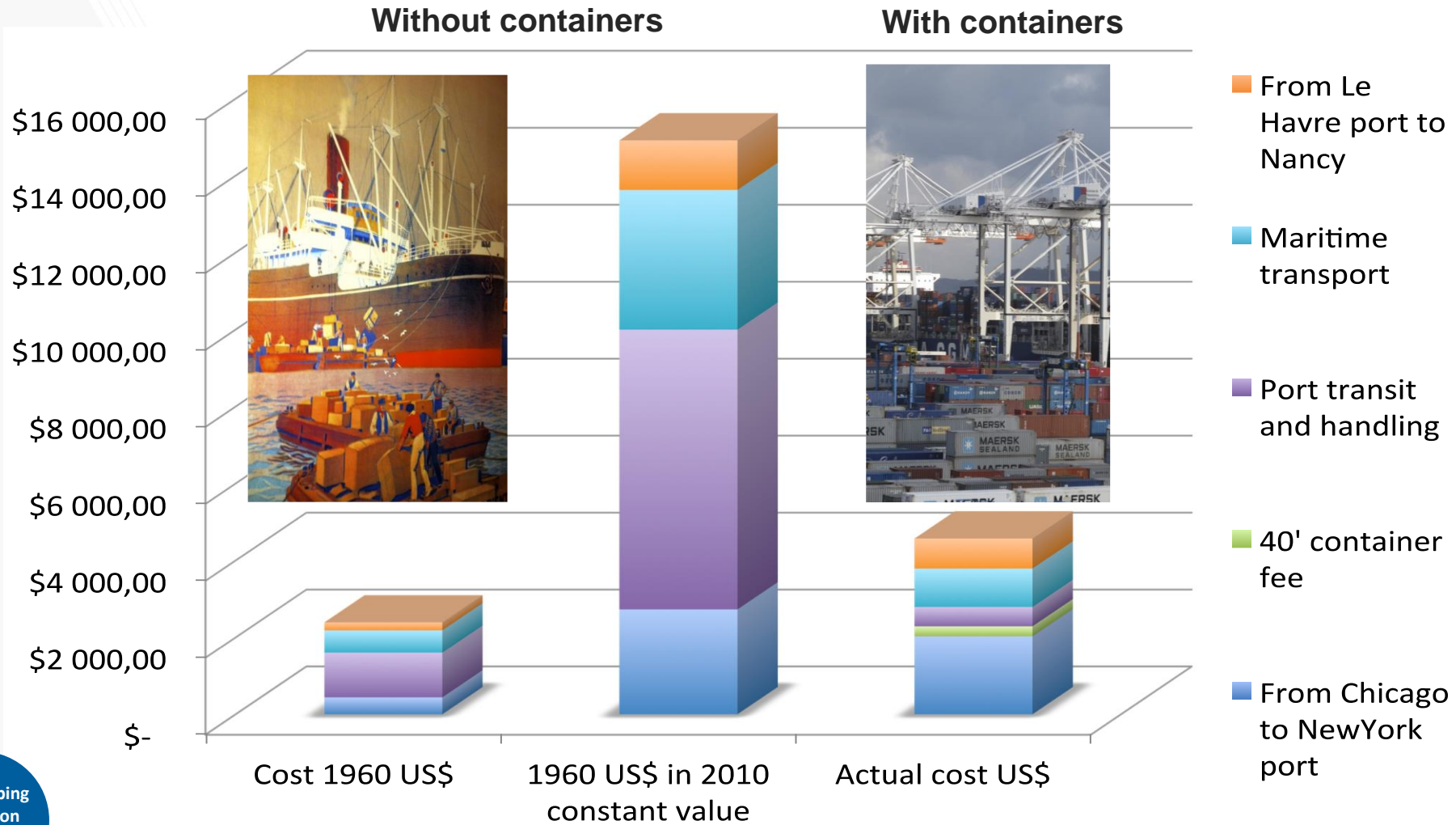
**To improve by an order of magnitude  
the economical, environmental and societal  
efficiency and sustainability  
of the way physical objects are  
moved, deployed, realized, supplied, designed and used**

**Induced cost reduction  
Price reduction  
Business opportunity  
Economic development opportunity**

**Reduction of  
Greenhouse gas emissions  
Energy consumption  
Waste  
Pollution  
Traffic & Congestion**

**Improved  
Quality of life  
Goods accessibility  
Mobility  
Novel service capabilities**

# Order-of-magnitude Improvements



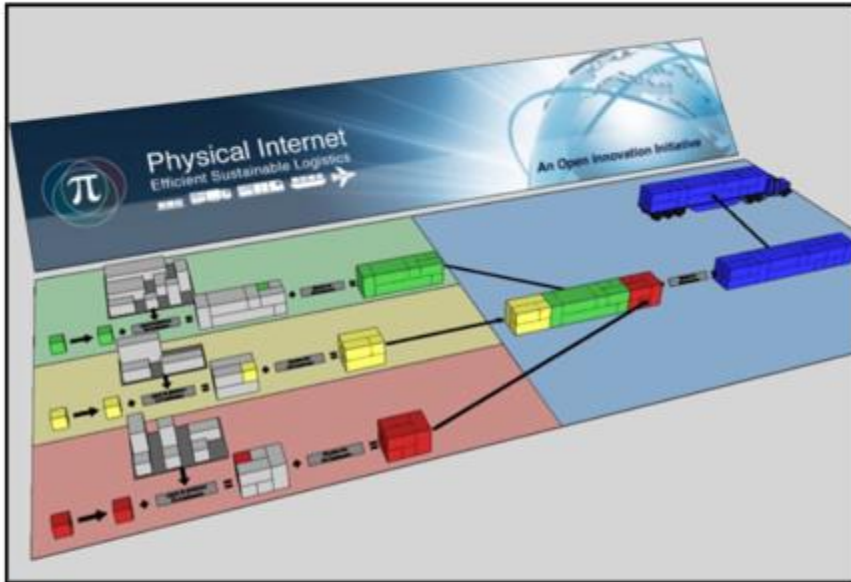
Handling cost / 14

Maritime trip cost / 4.5

Trucking cost / 1.5



# Physical Internet Building Blocks



B. Montreuil & C. Thivierge, 2011

Enabling **Efficient, Sustainable, Smart, Agile, Adaptable, Scalable, Resilient, Hyperconnected** Supply Chains

Certified Open Logistics Service Providers

Smart Data-Driven Analytics, Optimization & Simulation

Open Logistics Decisional & Transactional Platforms

Global Logistics Monitoring System

Certified Open Logistics Facilities and Ways

Standard Logistics Protocols

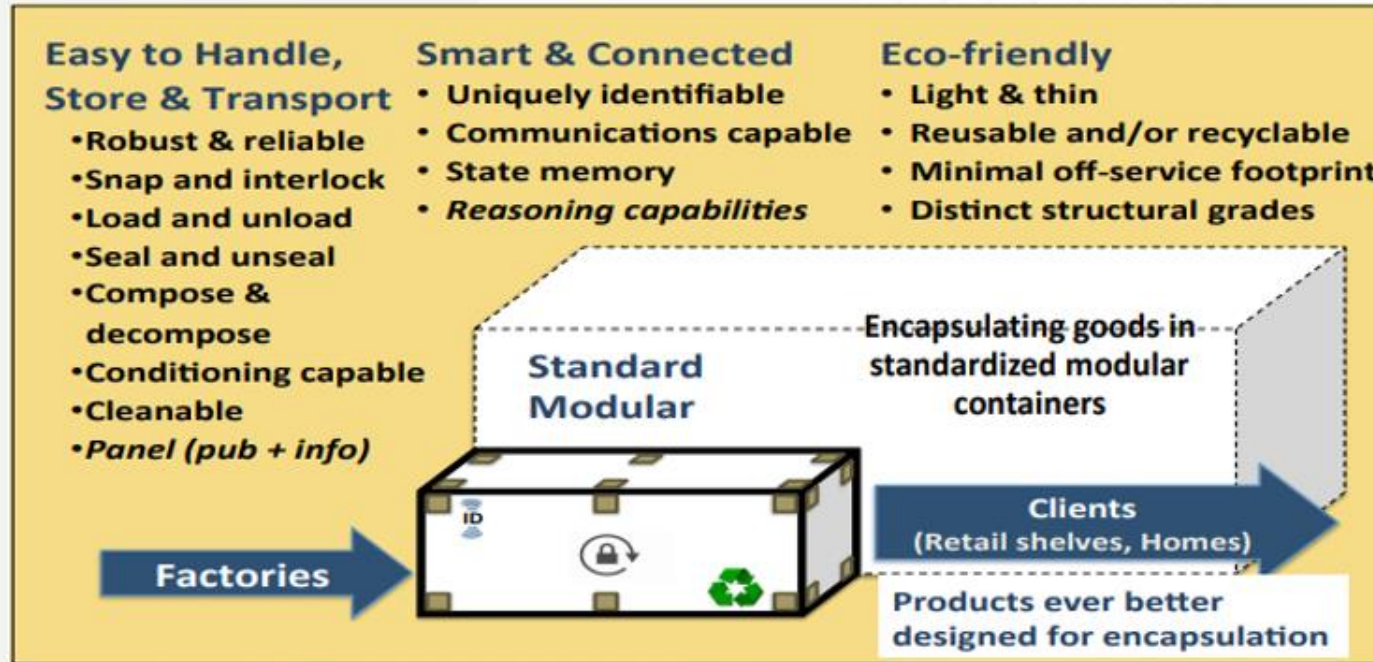
Containerized Logistics Equipment and Technology

Unified Set of Standard Modular Logistics Containers

[www.Picenter.gatech.edu](http://www.Picenter.gatech.edu)



# Ubiquitous Modular Containerization



- Private nest in an open space
- Used throughout the Physical Internet
- Owned by producer, pooler, logistic service provider, or user
- Transacted on the spot as pertinent
- No need to return to source
- Reused numerous times
- Drastically eases handling activities

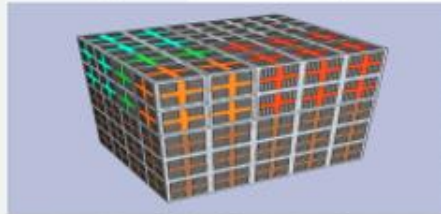
**Packaging Containers (Packs)**



**Modular fit in Boxes**

1,2; 0,8; 0,6; 0,4; 0,3; 0,2; 0,1  
– ε - δ meters

**Handling Containers (Totes, Boxes)**



**Modular fit in Pods**

Boxes: 1,2; 0,8; 0,6 – ε meters  
Totes: 0,6; 0,4; 0,3; 0,2; 0,1 – ε' meters

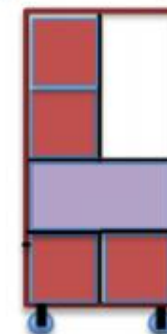
**Transport Containers (Pods)**



**Modular fit in certified vehicles-carriers**

12; 6; 4,8; 3,6; 2,4; 1,2 meters

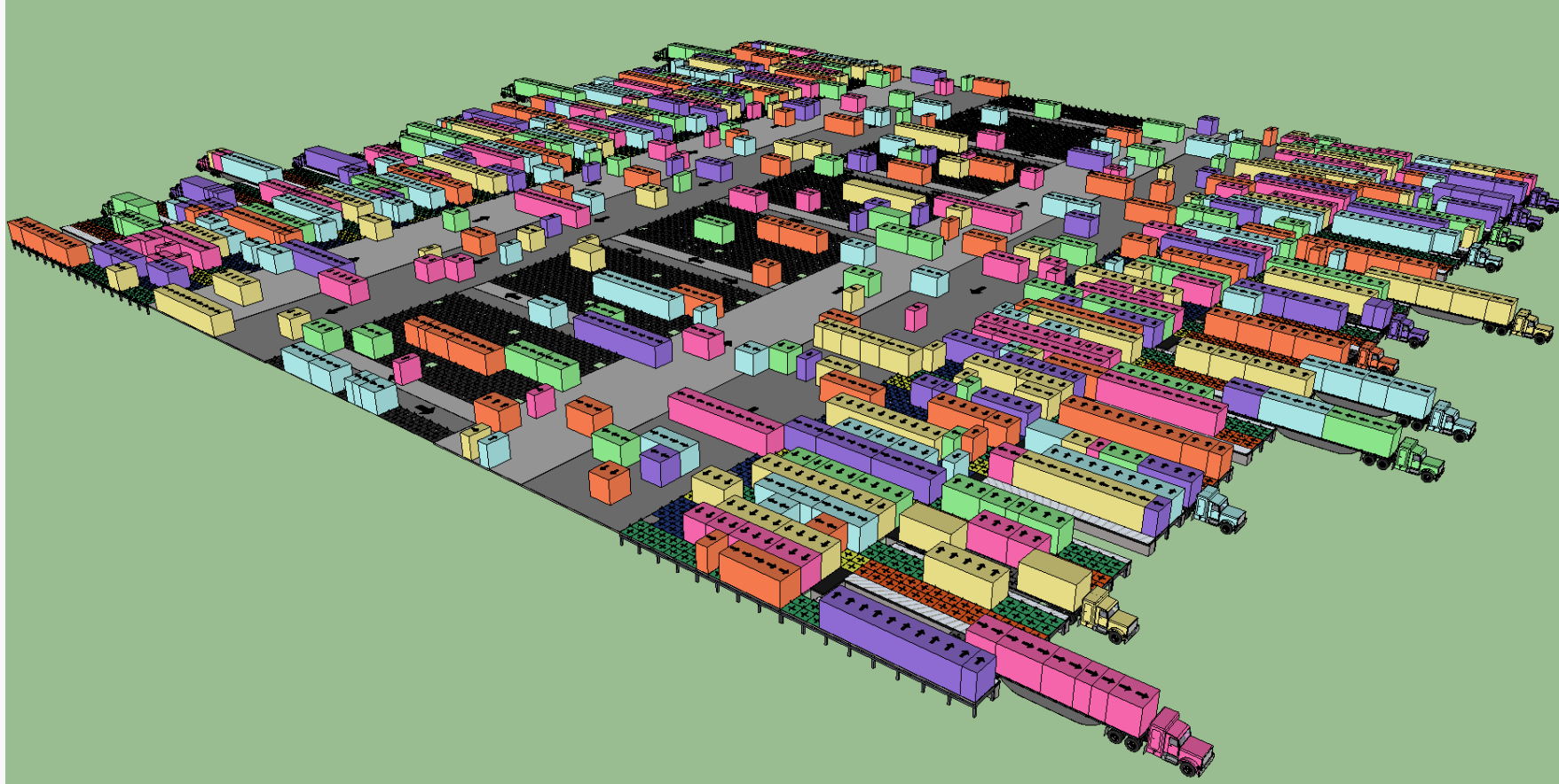
**Mobile Racks (unitizing handling containers)**



Modular fit in pods  
Same footprint as boxes

# Hyperconnected Logistics Facilities

New generation of logistics facilities enabling seamless, fast, cheap, safe, reliable, distributed, multimodal transport and deployment of  $\pi$ -containers across the Physical Internet



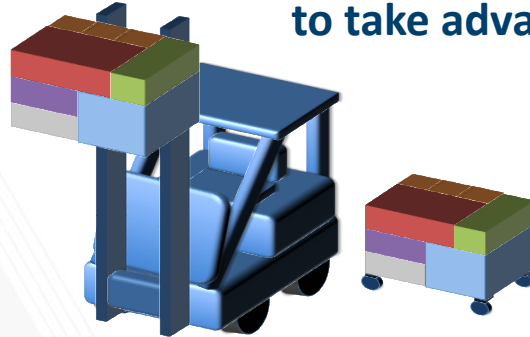
Montreuil, B., R.D. Meller, C. Thivierge, C., and Z. Montreuil (2014). *Functional Design of Physical Internet Facilities: A Unimodal Road-Based Crossdocking Hub*, p. 379-431;  
Ballot, E., B. Montreuil & C. Thivierge (2014). *Functional Design of Physical Internet Facilities: A Road-Rail Hub*, p. 28-61;  
In *Progress in Material Handling Research* Vol. 12, Ed. B. Montreuil, A. Carrano, K. Gue, R. de Koster, M. Ogle & J. Smith, MHI, Charlotte, NC, USA.



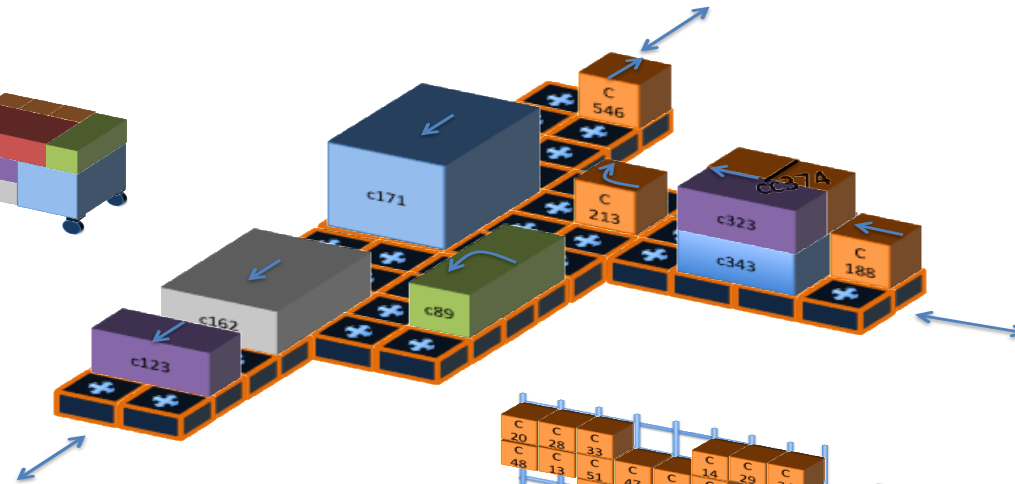
# $\pi$ -container handling and Storage Technologies

Rethinking material handling technologies  
such as lift trucks, conveyors, sorters, and storage racks  
to take advantage of the standard modular smart  $\pi$ -container

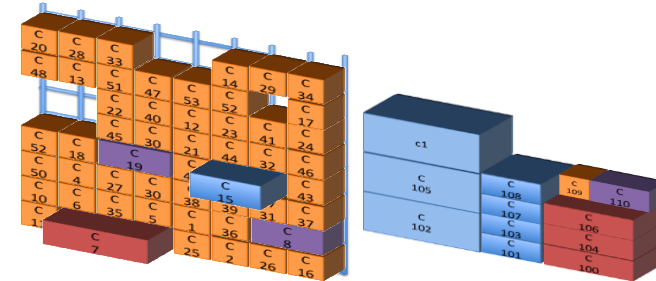
$\pi$ -movers



$\pi$ -conveyors



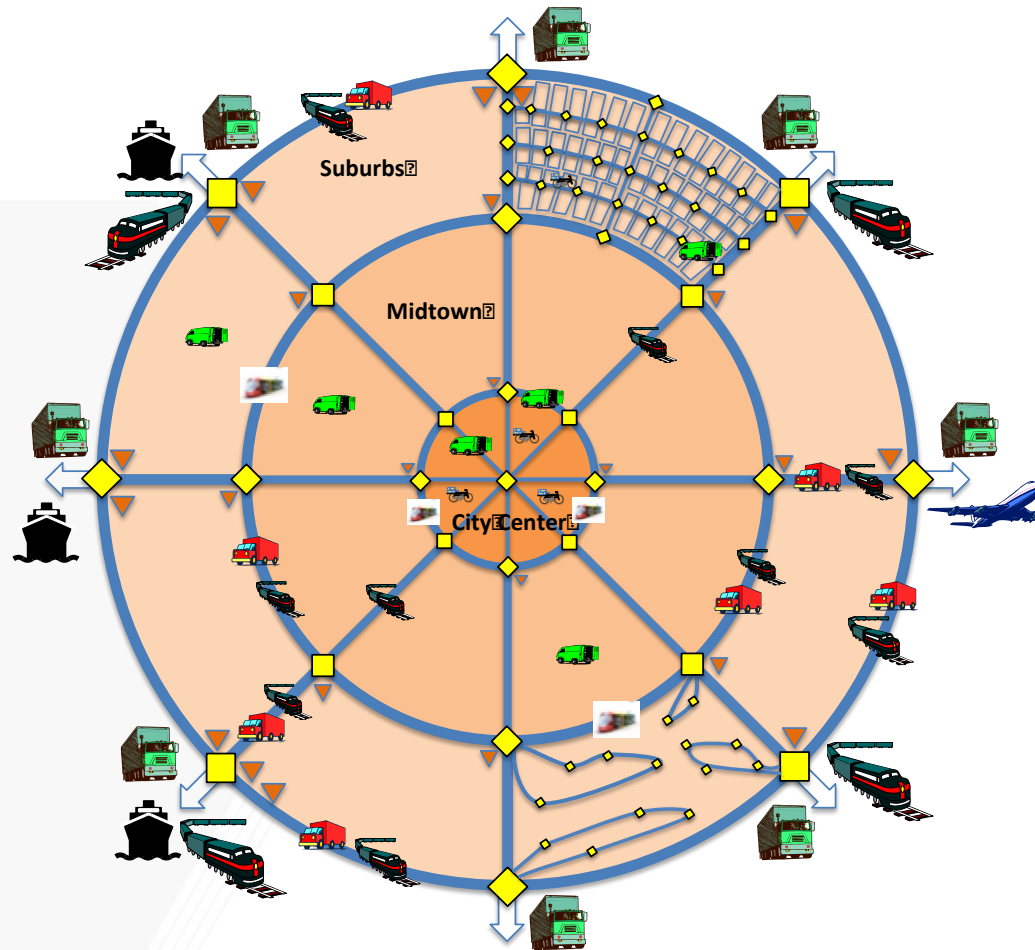
$\pi$ -stores



Fast, cheap, easy, safe and reliable flow  
through smart, seamless and sustainable automation, robotics and human handling

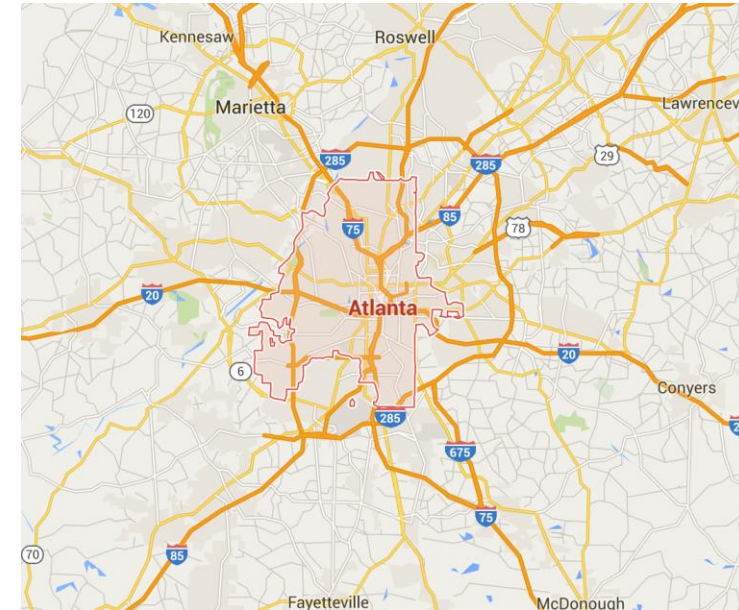
Reference: Montreuil, B., R.D. Meller, E. Ballot (2010) *Towards a physical internet: the impact on logistics facilities and material handling systems design and innovation*, in Progress in Material Handling Research, Edited by K. Gue et al., Material Handling Industry of America, 23 p., 2010.

# Hyperconnecting City Logistics & Supply Chains



**Exploiting existing infrastructures**  
(airport, MARTA, tramway, highways, nearby ports)  
and gradually developing innovative hyperconnected  
infrastructures

**Exploiting most zone-appropriate  
 $\pi$ -container transport, handling & storage  
modes, vehicles, means & facilities**



**Building on synergies between  
freight logistics and people mobility**

**Aiming for gains  
in economic, environmental and societal  
efficiency and sustainability**



# Hyperconnected Multimodal Transportation of Current Transport Containers

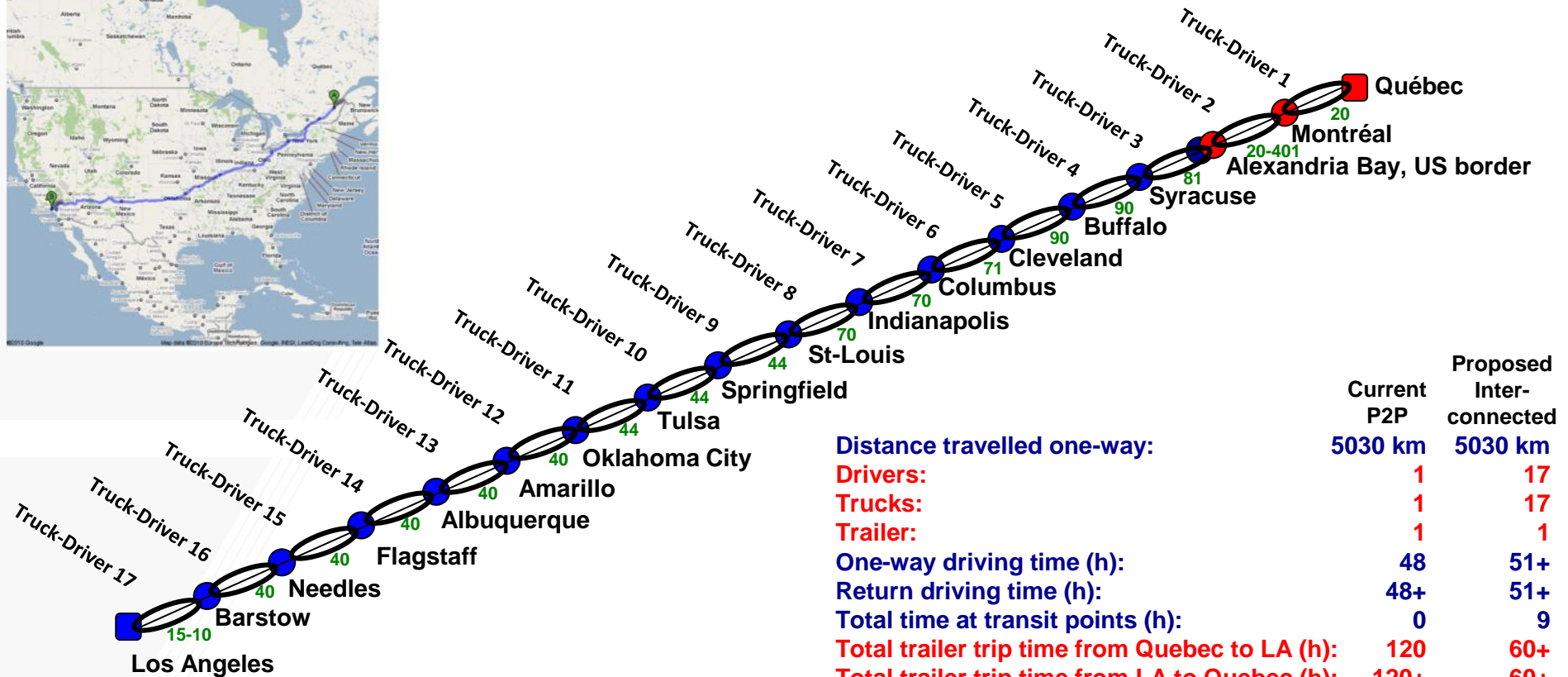
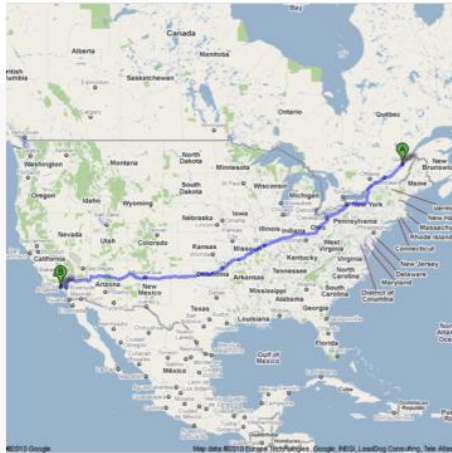




# Hyperconnecting transportation

## Illustrated through semi-trailer transport from Québec City to Los Angeles

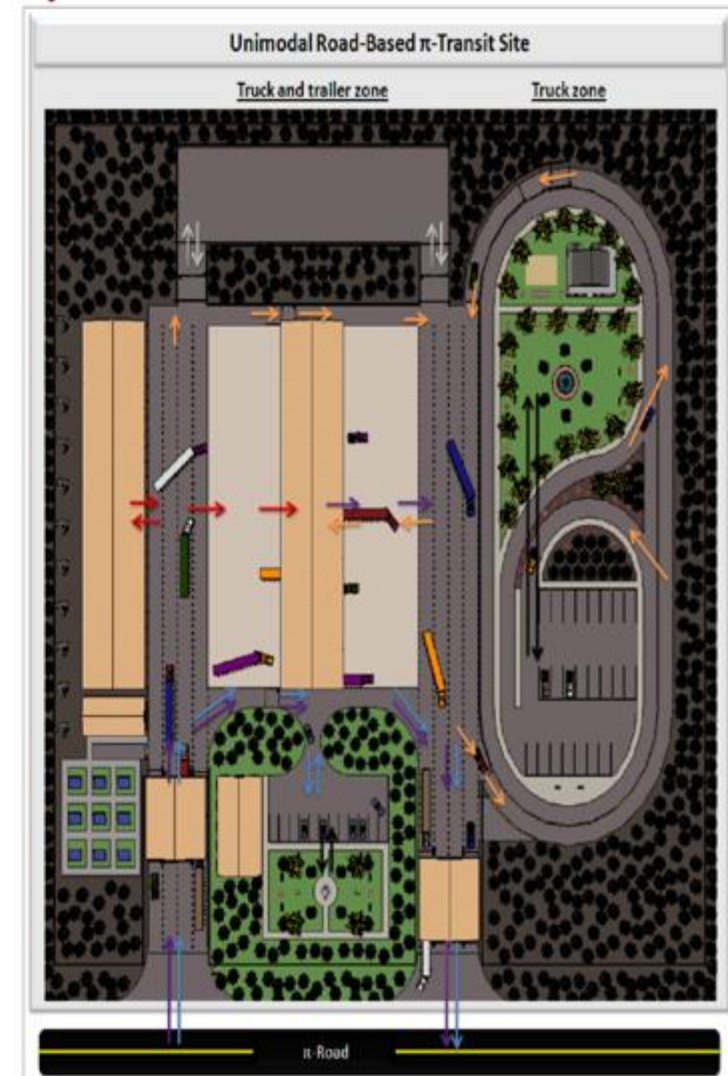
Google maps  
Itinéraire vers Los Angeles, CA  
5 030 km - environ 2 jours 9 heures



Using currently available trucks  
with a single driver per truck

# Hyperconnecting Trailer Transportation

## Exploiting Open Transit Centers to Tranship Semi-Trailers



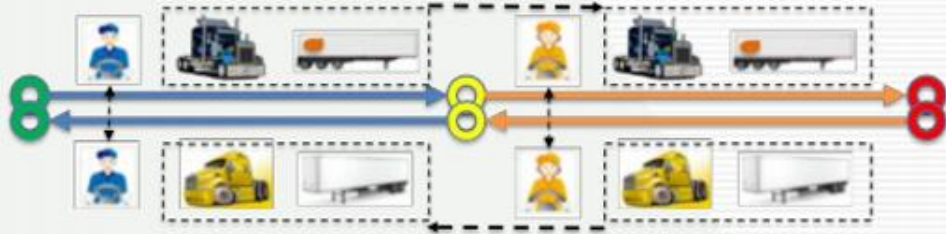
Using SketchUp

Meller, R.D., B. Montreuil, C. Thivierge & Z. Montreuil (2014). *Functional Design of Physical Internet Facilities*:



# Next Generation Logistics Hubs

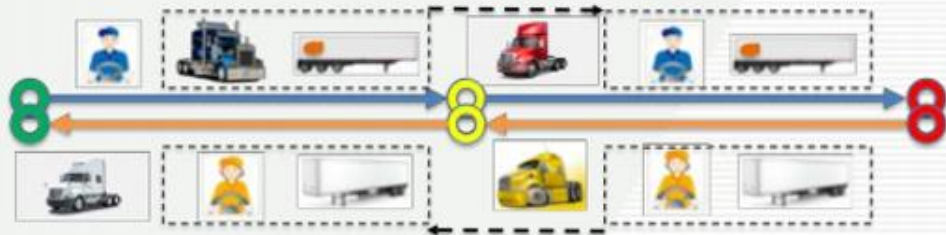
## Driver Swapping



## Carrier Swapping (semi-trailer, railcar...)



## Tractor Swapping (e.g. trucks needing to recharge)



## Transport Container Transshipment (unimodal or intermodal)



Tractor parking, fueling, charging, servicing  
Driver waiting, eating, resting, cleaning

Carrier parking, servicing  
Container parking, servicing



# Nissan working with Georgia Tech on improving vehicle deliveries and truck driver routes

By Marcus Williams | 25 June 2021



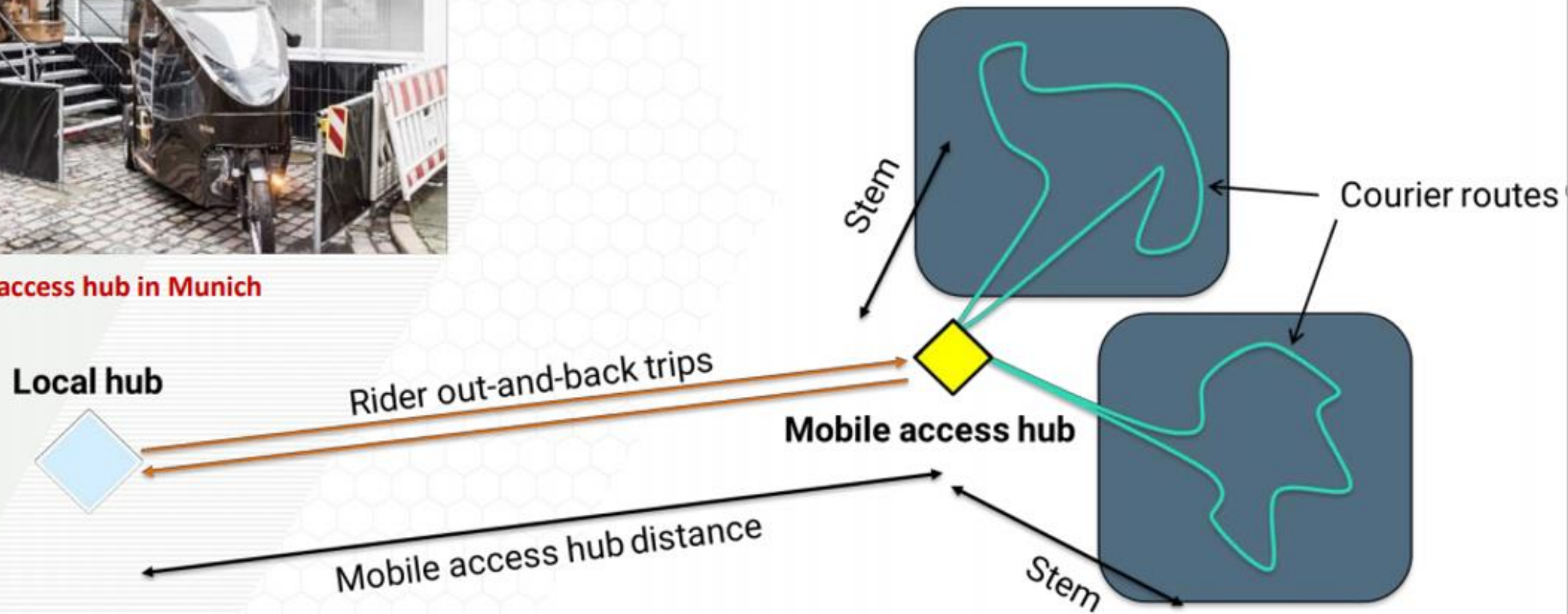
Nissan North America is ten months into an 18-month pilot project that aims to tackle capacity pressures in finished vehicle road haulage, improve delivery times and make the job of delivering vehicles more attractive to freight drivers – three of the main challenges facing the vehicle logistics sector today in the US.

# Embracing Modularity, Scalability, and Mobility of Facilities



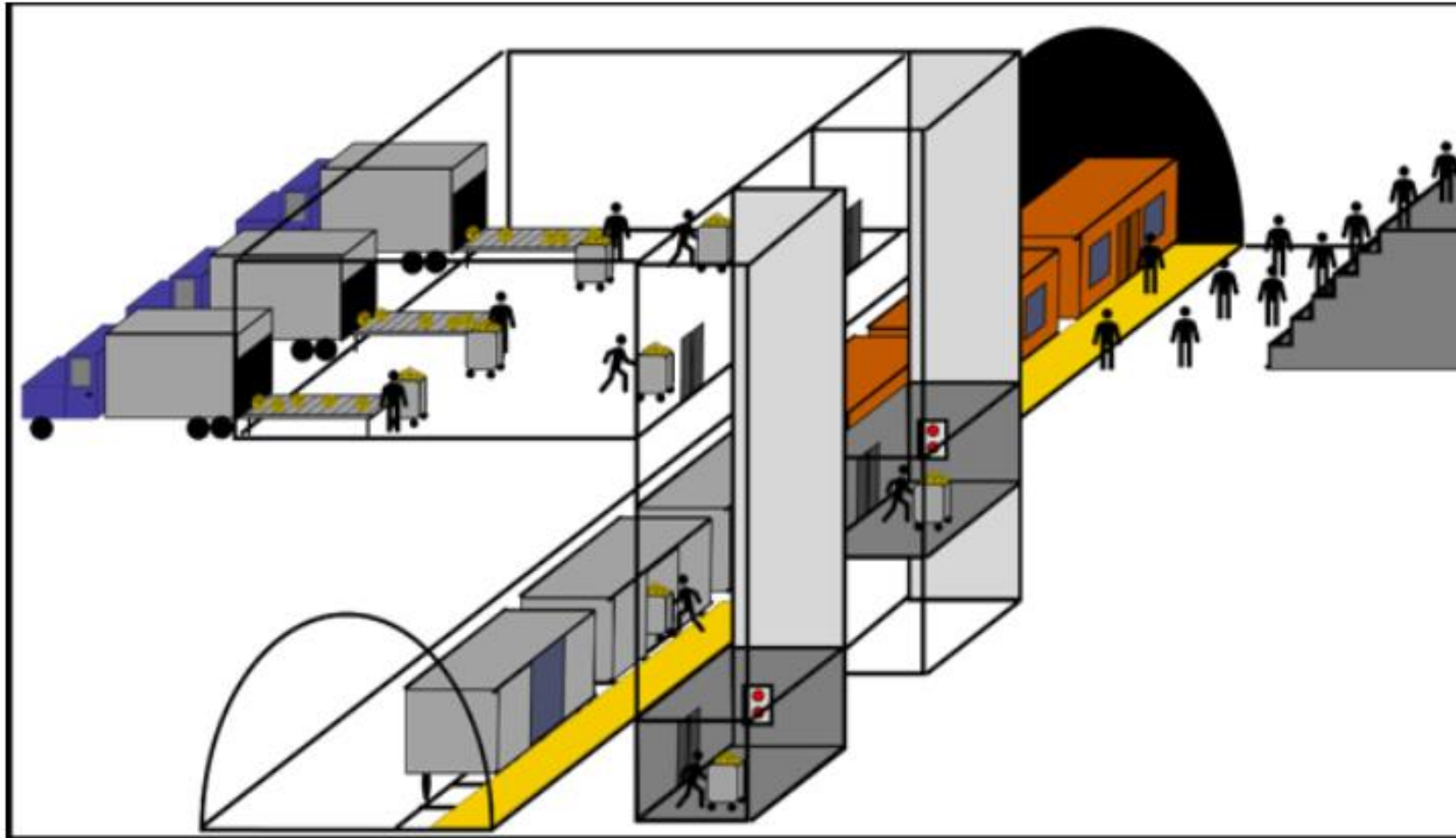
UPS's mobile access hub in Munich

## Leveraging Mobile Access Hubs



Faugère, L., White III, C., Montreuil, B. (2020). Mobile Access Hub Deployment for Urban Parcel Logistics. Sustainability, 12(17) 7213

# New Uses for Public Transit



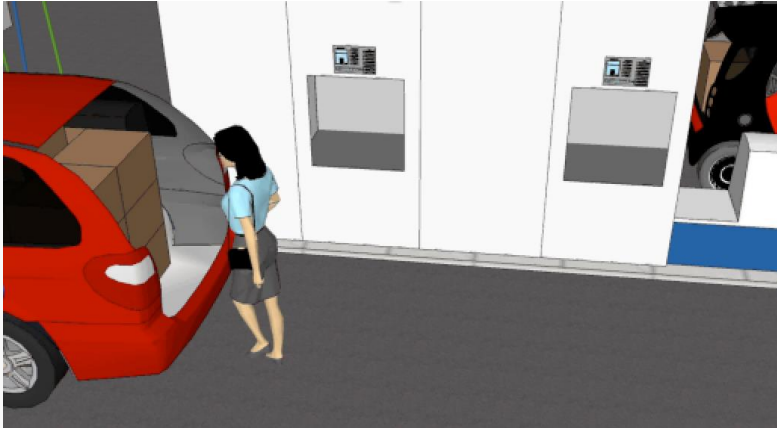
Hub-based interconnection of truck-based and subway-based transport for smart urban synchromodal flow



# Hyperconnected Crowdsourced Delivery

Having people carry modular containers

Using public transit, bicycles, cars, vans... in town or across regions



Exploiting smartphone-based apps

Pickup packs at hub near departure

Deliver them at hub near arrival, **making money**

**Others carry them further toward destination**

Expanding for freight way beyond current capabilities of Uber for people

# Autonomous Transportation

## PUSH TOWARD DRIVERLESS VEHICLES AND MOBILE ROBOTS



www.foxnews.com



theloadstar.co.uk



TechOn - [http://techon.nikkeibp.co.jp/english/NEWS\\_EN/20130227/268437/](http://techon.nikkeibp.co.jp/english/NEWS_EN/20130227/268437/) - See more at: <http://www.capfalcon.net/2013/03/23/road-convoy-this-is-an-autonomous-driving-of-4-trucks-in-formation/#sthash.392DvjGq.dpuf>



**Autonomous  
Cars & Delivery Vehicles**

**Autonomous  
Trucks, Platoons/Convoys**

**Delivery Droids & Drones**

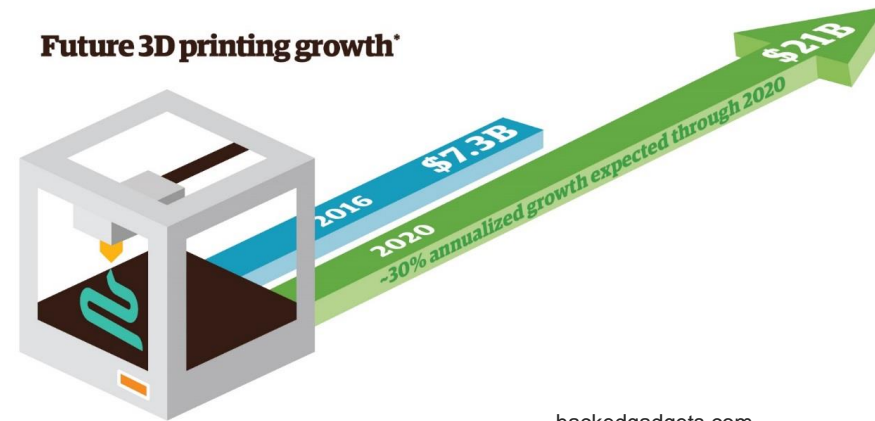


# Additive Manufacturing

## PROXIMITY PRINTING OF PARTS ON DEMAND



MetalFab1 3D Printer: 1.1 M€



[hackedgadgets.com](http://hackedgadgets.com)



- Easy to distribute, near-point-of-use
- Inbound Materials Logistics is critical

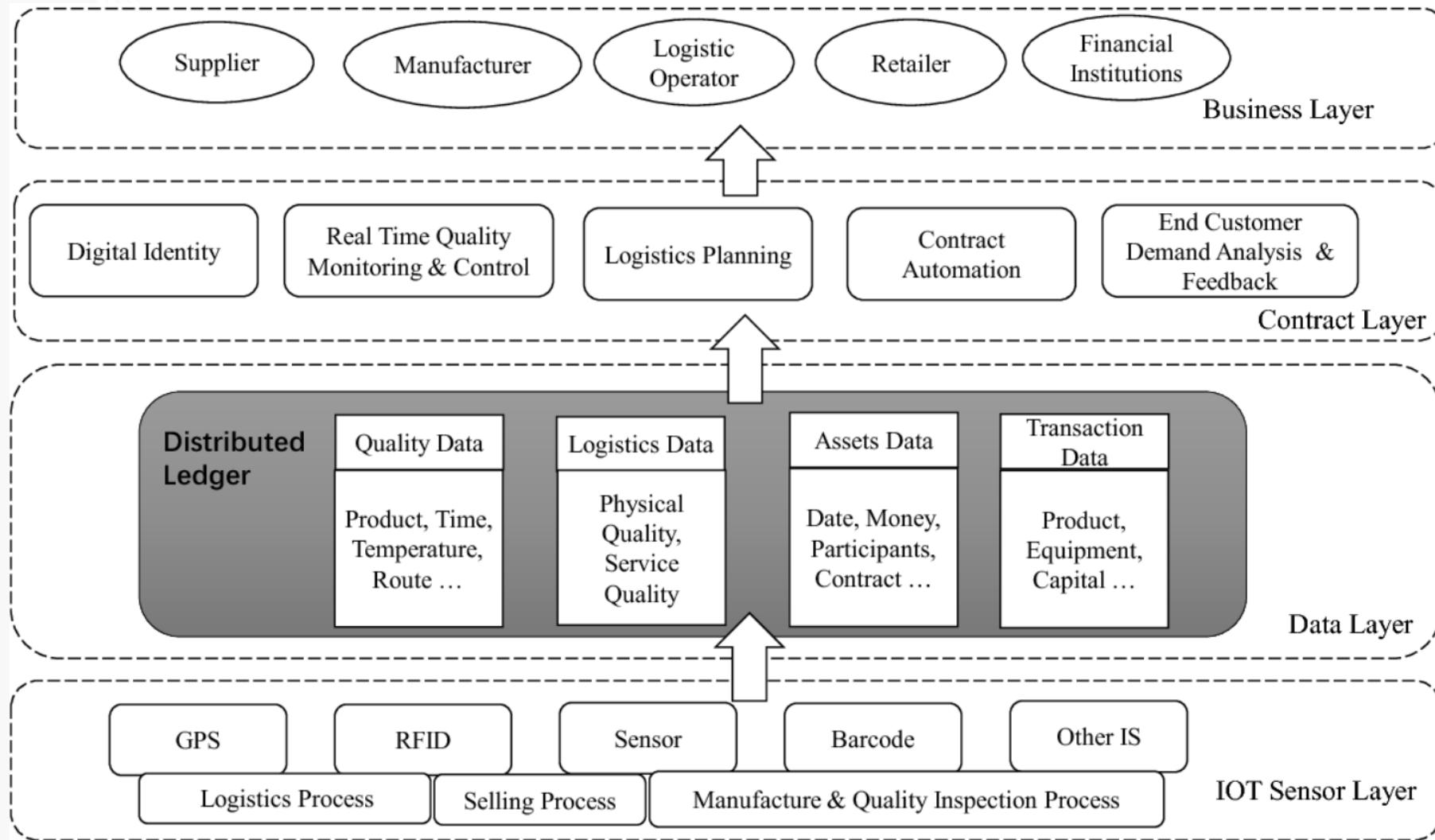


[www.shellypalmer.com](http://www.shellypalmer.com)



[3dprint.com](http://3dprint.com)

# Blockchain in the Supply Chain





## **Global Manufacturing/Distribution**

Coca-cola  
Newell Rubbermaid  
Kia  
Georgia Pacific  
Kimberly Clark  
Clorox  
Colgate Palmolive  
YKK  
Gulfstream  
Lockheed

## **Logistics Materials**

WestRock  
Graphic Packaging  
Printpak  
Veritiv

## **Retail/Distribution**

The Home Depot  
NAPA  
Carters  
Inspire Brands  
Genuine Parts  
HD Supply

## **Software/Consulting**

Manhattan Associates  
American Software  
Logility  
Chainalytics  
Fortna  
Hy-Tek Material Handling  
Accenture  
McKinsey  
Competitive Insights  
Spend Management Experts  
Elemica

## **Academia**

Georgia Tech  
Clayton State  
University of North Georgia  
Kennesaw State  
UGA  
Georgia Southern  
Georgia College and State University  
Middle Georgia

## **Carriers/Equipment/3PLs**

Norfolk Southern  
Delta  
UPS  
CSX  
Gulfstream  
Lockheed  
Great Dane  
Americold  
Dematic  
Knapp  
Vanderlande  
Americold

## Autos & Transportation

**EXCLUSIVE Ford Motor, SK Innovation to announce EV battery joint venture -sources**

**Inc. 5000** INC. 5000

**How This Cloud-Based Logistics Company Could Revolutionize the Global Supply Chain** Stord's warehousing platform started as a student project before proving itself as a much-needed marketplace for space. 

**Dematic**  
Supply chain company shifting global HQ to Midtown, pledging \$30M investment and 230 jobs

## Gov. Kemp Announces GreyOrange Global Headquarters in Georgia



ATLANTA, April 26, 2021 —Governor Brian P. Kemp today announced that GreyOrange, a global leader in AI-enabled software and robotics for fulfillment automation, is investing more than \$1 million in relocating its global headquarters to metro Atlanta. This move will create 200 additional jobs in the area.

Netherlands-based Vanderlande Industries, a maker of conveyance systems with installations at more than 600 airports worldwide, is set to expand its North American headquarters in Georgia, investing \$59 million and hiring 500 in Marietta.



Interroll Atlanta Celebrates Grand Opening of New Regional Center of Excellence in Hiram, Georgia



# State Government Support

- Recognize and embrace the breadth, depth, and impact of Supply Chain and Logistics in Georgia
- Recognize that Support of Supply Chain does not equal more roads/roundabouts etc.
- Recognize the unique opportunity Georgia has to be national leader in Next Generation Logistics and Foster through:
  - Supportive legislation/regulation - autonomous, drones, truck drivers, freight/human mobility, transit system usage, etc.
  - Encouraging community experimentation – e.g. Peachtree Corners/Curiosity Labs, Smart Cities Georgia
  - Building review of fit to future operating models into all infrastructure investments
  - Private/Public partnerships to create well-located multi-purpose logistics hubs (driver/trailer swap, weigh, fuel, quick-exchange freight, etc.)
  - Encourage investment in Innovation
  - Engage with Academic Researchers

# Georgia: The Supply Chain State

